

VI. REFERENCES

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VII. APPENDIX

A. LIST OF SCIENTIFIC AND COMMON NAMES OF PLANTS AND ANIMALS

Common Name	Scientific Name
PLANTS	
Alkali heath	<i>Frankenia salina</i>
Alkali sacaton	<i>Sporobolus airoides</i>
Anderson desert thorn	<i>Lycium andersonii</i>
Annual fescue	<i>Vulpia microstachys</i>
Arabian grass	<i>Schismus arabicus</i>
Arabian grass species	<i>Schismus</i> spp.
Arrowscale	<i>Atriplex phyllostegia</i>
Bakersfield cactus	<i>Opuntia basilaris</i> var. <i>treleasei</i>
Bakersfield smallscale	<i>Atriplex tularensis</i>
Baltic rush	<i>Juncus balticus</i>
Beavertail cactus	<i>Opuntia basilaris</i>
Big saltbush	<i>Atriplex lentiformis</i>
Bladderpod	<i>Isomeris arborea</i>
Booth's evening primrose	<i>Camissonia boothii</i>
Bractscale	<i>Atriplex serenana</i>
Brittlescale	<i>Atriplex depressa</i>
California blackberry	<i>Rubus ursinus</i>
California buckwheat	<i>Eriogonum fasciculatum</i>
California ephedra	<i>Ephedra californica</i>
California filago	<i>Filago californica</i>
California jewelflower	<i>Caulanthus californicus</i>
California juniper	<i>Juniperus californica</i>
California poppy	<i>Eschscholzia californica</i>
California wild rose	<i>Rosa californica</i>
Carrizo peppergrass	<i>Lepidium jaredii</i> ssp. <i>jaredii</i>
Chaparral yucca	<i>Yucca whipplei</i>
Cheesebush	<i>Hymenoclea salsola</i>
Chinese lantern phacelia	<i>Phacelia ciliata</i>
Clover species	<i>Trifolium</i> spp.
Comanche Point layia	<i>Layia leucopappa</i>
Common saltbush	<i>Atriplex polycarpa</i>
Common spikeweed	<i>Hemizonia pungens</i>
Common tidy-tips	<i>Layia platyglossa</i>
Coyote bush	<i>Baccharis</i> sp.
Coyote-mint	<i>Monardella villosa</i>
Crownscale	<i>Atriplex coronata</i>
Desert mallow	<i>Eremalche exilis</i>
Diamond-petaled California poppy	<i>Eschscholzia rhombipetala</i>
Douglas' coyote bush	<i>Baccharis douglasii</i>
Eastwoodia	<i>Eastwoodia elegans</i>
Eastwood's buckwheat	<i>Eriogonum eastwoodianum</i>

A. List of Scientific and Common Names of Plants and Animals (continued)

Common Name	Scientific Name
Everlasting neststraw	<i>Stylocline gnaphaloides</i>
Ephedra	<i>Ephedra</i> spp.
Farewell-to-spring	<i>Clarkia cylindrica</i>
Fiddleneck	<i>Amsinckia</i> spp.
Filaree	<i>Erodium</i> spp.
Fremont poplar	<i>Populus fremontii</i>
Frying pans	<i>Eschscholzia lobbii</i>
Glasswort	<i>Salicornia subterminalis</i>
Goldenbush	<i>Ericameria</i> , <i>Haplopappus</i> , and <i>Isocoma</i> spp.
Goldfields	<i>Lasthenia californica</i>
Greasewood	<i>Sarcobatus vermiculatus</i>
Green clover	<i>Trifolium wormskioldii</i>
Green ephedra	<i>Ephedra viridis</i>
Gunsight clarkia	<i>Clarkia unguiculata</i>
Haplopappus species	<i>Haplopappus</i> spp.
Heartscale	<i>Atriplex cordulata</i>
Hillside daisy	<i>Monolopia lanceolata</i>
Hispid bird's beak	<i>Cordylanthus mollis</i> ssp. <i>hispidus</i>
Hollisteria	<i>Hollisteria lanata</i>
Honey mesquite	<i>Prosopis glandulosa</i> var. <i>torreyana</i>
Hoover's woolly-star	<i>Eriastrum hooveri</i>
Idria buckwheat	<i>Eriogonum vestitum</i>
Iodine bush	<i>Allenrolfea occidentalis</i>
Jared's peppergrass	<i>Lepidium jaredii</i>
Jones' tidy-tips	<i>Layia jonesii</i>
Kern mallow	<i>Eremalche kernensis</i>
Large-leaved filaree	<i>Erodium macrophyllum</i>
Leafy-stemmed coreopsis	<i>Coreopsis calliopsidea</i>
Lemmon's poppy	<i>Eschscholzia lemmonii</i> ssp. <i>lemmonii</i>
Lesser saltscala	<i>Atriplex minuscula</i>
Lost Hills saltbush	<i>Atriplex vallicola</i>
Many-flowered eriastrum	<i>Eriastrum pluriflorum</i>
Marsh baccharis	<i>Baccharis douglasii</i>
Matchweed	<i>Gutierrezia californica</i>
Merced monardella	<i>Monardella leucocephala</i>
Merced phacelia	<i>Phacelia ciliata</i> var. <i>opaca</i>
Mouse-tail fescue	<i>Vulpia myuros</i>
Mulefat	<i>Baccharis salicifolia</i>
Munz's tidy-tips	<i>Layia munzii</i>
Narrowleaf goldenbush	<i>Ericameria linearifolia</i>
Oil neststraw	<i>Stylocline citroleum</i>
One-sided bluegrass	<i>Poa secunda</i> ssp. <i>secunda</i>
Pacific blackberry	<i>Rubus vitifolius</i>

A. List of Scientific and Common Names of Plants and Animals (continued)

Common Name	Scientific Name
Pale-leaf goldenbush	<i>Isocoma acradenia</i> var. <i>bracteosa</i>
Palmate-bracted bird's beak	<i>Cordylanthus palmatus</i>
Panoche peppergrass	<i>Lepidium jaredii</i> ssp. <i>album</i>
Parish's brittlescale	<i>Atriplex parishii</i>
Parry's mallow	<i>Eremalche parryi</i> ssp. <i>parryi</i>
Parry's saltbush	<i>Atriplex parryi</i>
Peppergrass	<i>Lepidium nitidum</i>
Pickleweed	<i>Salicornia subterminalis</i>
Purple needlegrass	<i>Nassella pulchra</i>
Quailbush	<i>Atriplex lentiformis</i>
Red brome	<i>Bromus madritensis</i> ssp. <i>rubens</i>
Red maids	<i>Calandrinia ciliata</i>
Red-stemmed filaree	<i>Erodium cicutarium</i>
Ripgut brome	<i>Bromus diandrus</i>
Saltbush	<i>Atriplex</i> spp.
Salt grass	<i>Distichlis spicata</i>
San Benito thornmint	<i>Acanthomintha obovata</i>
San Joaquin woolly-threads	<i>Lembertia congdonii</i>
Scalebroom	<i>Lepidospartum</i> sp.
Scratchgrass	<i>Muhlenbergia asperifolia</i>
Seepweed	<i>Suaeda moquinii</i>
Shadscale	<i>Atriplex confertifolia</i>
Shepherd's purse	<i>Capsella bursa-pastoris</i>
Sierra monardella	<i>Monardella candicans</i>
Snowy eatonella	<i>Eatonella nivea</i>
Soft chess	<i>Bromus hordeaceus</i>
Spiny saltbush	<i>Atriplex spinifera</i>
Springville clarkia	<i>Clarkia springvillensis</i>
Sun cups	<i>Camissonia californica</i>
Tejon poppy	<i>Eschscholzia lemmonii</i> ssp. <i>kernensis</i>
Temblor buckwheat	<i>Eriogonum temblorense</i>
Temblor clarkia	<i>Clarkia tembloriensis</i>
Tufted poppy	<i>Eschscholzia caespitosa</i>
Vasek's clarkia	<i>Clarkia tembloriensis</i> ssp. <i>calientensis</i>
White Sierran layia	<i>Layia pentachaeta</i> ssp. <i>albida</i>
Wild barley	<i>Hordeum</i> sp.
Wild grape	<i>Vitis californica</i>
Wild oats	<i>Avena fatua</i>
Wild-rye	<i>Elymus</i> sp.
Willow species	<i>Salix</i> spp.
Winterfat	<i>Krascheninnikovia lanata</i>
Woolly goldfields	<i>Lasthenia minor</i>
Yellow pincushion	<i>Chaenactis glabriuscula</i>

A. List of Scientific and Common Names of Plants and Animals (continued)

Common Name	Scientific Name
ANIMALS	
American badger	<i>Taxidea taxus</i>
American kestrel	<i>Falco sparverius</i>
American opossum	<i>Marsupialia virginiana</i>
Barn owl	<i>Tyto alba</i>
Bendire's thrasher	<i>Toxostoma bendirei</i>
Black-tailed hare	<i>Lepus californicus</i>
Blunt-nosed leopard lizard	<i>Gambelia sila</i>
Bobcat	<i>Felis rufa</i>
Buena Vista Lake shrew	<i>Sorex ornatus relictus</i>
Bumblebee	<i>Bombus californicus</i>
Bumblebee	<i>Bombus occidentalis</i>
Bumblebee	<i>Bombus vosnesenskii</i>
Burrowing owl	<i>Athene cunicularia</i>
California condor	<i>Gymnogyps californianus</i>
California ground squirrel	<i>Spermophilus beecheyi</i>
California pocket mouse	<i>Chaetodipus californicus</i>
California thrasher	<i>Toxostoma redivivum</i>
California whiptail	<i>Cnemidophorus tigris</i>
Chukar	<i>Alectoris chukar</i>
Ciervo aegialian scarab beetle	<i>Aegialia concina</i>
Coachwhip	<i>Masticophis flagellum</i>
Coast horned lizard	<i>Phrynosoma coronatum</i>
Common king snake	<i>Lampropeltis getulus</i>
Coyote	<i>Canis latrans</i>
Crissal thrasher	<i>Toxostoma dorsale</i>
Deer mouse	<i>Peromyscus maniculatus</i>
Desert cottontail	<i>Sylvilagus audubonii</i>
Desert thrasher	<i>Toxostoma lecontei arenicola</i>
Domestic dog	<i>Canis familiaris</i>
Doyen's dune weevil	<i>Trigonoscutea sp.</i>
Dusky-footed woodrat	<i>Neotoma fuscipes</i>
Feral cat	<i>Felis sylvestris</i>
Fresno kangaroo rat	<i>Dipodomys nitratoideus exilis</i>
Giant garter snake	<i>Thamnophis gigas</i>
Giant kangaroo rat	<i>Dipodomys ingens</i>
Glossy snake	<i>Arizona elegans</i>
Golden eagle	<i>Aquila chrysaetos</i>
Gopher snake	<i>Pituophis melanoleucus</i>
Gray fox	<i>Urocyon cinereoargenteus</i>
Great-horned owl	<i>Bubo virginianus</i>
Greater roadrunner	<i>Geococcyx californianus</i>
Heermann's kangaroo rat	<i>Dipodomys heermanni</i>

A. List of Scientific and Common Names of Plants and Animals (continued)

Common Name	Scientific Name
Honey bee	<i>Apis mellifera</i>
House mouse	<i>Mus musculus</i>
Le Conte's thrasher	<i>Toxostoma lecontei</i>
Loggerhead shrike	<i>Lanius ludovicianus</i>
Long-nosed leopard lizard	<i>Gambelia wislizenii</i>
Long-tailed weasel	<i>Mustela frenata</i>
McKittrick pocket mouse	<i>Perognathus inornatus neglectus</i>
Merriam's kangaroo rat	<i>Dipodomys merriami</i>
Mountain plover	<i>Charadrius montanus</i>
Northern mockingbird	<i>Mimus polyglottus</i>
Ornate shrew	<i>Sorex ornatus</i>
Red-shouldered hawk	<i>Buteo lineatus</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Red fox	<i>Vulpes vulpes</i>
Riparian brush rabbit	<i>Sylvilagus bachmani riparius</i>
Riparian woodrat	<i>Neotoma fuscipes riparius</i>
Roof rat	<i>Rattus rattus</i>
Sage thrasher	<i>Oreoscoptes montanus</i>
Salt marsh harvest mouse	<i>Reithrodontomys raviventris</i>
San Joaquin antelope squirrel	<i>Ammospermophilus nelsoni</i>
San Joaquin dune beetle	<i>Coleus gracilis</i>
San Joaquin kangaroo rat	<i>Dipodomys nitratoideus</i>
San Joaquin kit fox	<i>Vulpes macrotis mutica</i>
San Joaquin LeConte's thrasher	<i>Toxostoma lecontei macmillanoura</i>
San Joaquin pocket mouse	<i>Perognathus inornatus</i>
Short-eared owl	<i>Asio flammeus</i>
Short-nosed kangaroo rat	<i>Dipodomys nitratoideus brevinasus</i>
Side-blotched lizard	<i>Uta stansburiana</i>
Southern grasshopper mouse	<i>Onychomys torridus</i>
Spiny lizard species	<i>Sceloporus spp.</i>
Spotted skunk	<i>Spilogale gracilis</i>
Stephen's woodrat	<i>Neotoma stephensi</i>
Striped skunk	<i>Mephitis mephitis</i>
Suisun shrew	<i>Sorex ornatus sinuosus</i>
Swainson's hawk	<i>Buteo swainsoni</i>
Swift fox	<i>Vulpes velox</i>
Tipton kangaroo rat	<i>Dipodomys nitratoideus nitratoideus</i>
Tulare grasshopper mouse	<i>Onychomys torridus tularensis</i>
Valley elderberry longhorn beetle	<i>Desmocerus californicus dimorphus</i>
Western gray squirrel	<i>Sciurus occidentalis</i>
Western harvest mouse	<i>Reithrodontomys megalotis</i>
Western long-nosed snake	<i>Rhinocheilus lecontei</i>
Western rattlesnake	<i>Crotalis viridis</i>
White-footed mouse species	<i>Peromyscus spp.</i>

B. GLOSSARY OF TECHNICAL TERMS

Term	Definition
<i>achene</i>	a tiny dry fruit with one seed
<i>adaptive management</i>	a long-term repeated process of gradually modifying management techniques based upon the results of modeling and research
<i>alkali scald</i>	barren area with a surface crust of salts
<i>alkali sink</i>	drainage basin with soil high in soluble salts
<i>alluvial fan</i>	fan-shaped area of soil deposited where a mountain stream first enters a valley or plain
<i>apomixis</i>	seed set without fertilization
<i>arid</i>	dry
<i>auditory bullae</i>	boney capsules containing the middle and inner ears
<i>biological niche</i>	all the physical and biological factors required for a particular species to live and its way of living
<i>biosystematic study</i>	research that uses evidence from several disciplines to determine the appropriate taxonomic placement and relationship to other species.
<i>bisexual</i>	having both male and female parts (said of a flower)
<i>bract</i>	a leaf-like structure that is associated with a flower; may be green or colored
<i>brummate</i>	dormancy in animals whose body temperature varies with their environment
<i>Caltrans</i>	California Department of Transportation
<i>calyx</i>	the group of leaf-like structures (sepals) in a flower immediately below the petals
<i>CDFG</i>	California Department of Fish & Game
<i>chenopod</i>	a plant in the goosefoot family (Chenopodiaceae)
<i>Ciervo-Panoche Natural Area</i>	natural lands along the western edge of the Valley and in the contiguous foothills and coastal range, from the Panoche Hills and Valley, Fresno and San Benito Counties, south to Anticline Ridge near Coalinga, Fresno Co.
<i>ciliate</i>	having stiff hairs along the margin
<i>cismontane</i>	west of the Sierra Nevada crest (literally on this side of the mountains)
<i>clumps</i>	groups of cactus pads that are rooted at the same point
<i>COE</i>	Army Corps of Engineers
<i>corolla</i>	the set of petals in a flower whether separate or fused

B. Glossary of Technical Terms (continued)

Term	Definition
<i>crissum</i>	undertail feathers
<i>cryptogamic crust</i>	a layer of moss, lichen, and algae on the soil surface
<i>disk florets</i>	tiny tubular flowers that are clustered in the center of a flower head, like a common daisy
<i>demography, demographic</i>	the study of populations with reference to birth and death rates, size and density, distribution, migration, and other vital statistics
<i>ear pinnae</i>	external ear flaps
<i>effective dispersal</i>	dispersal of genes
<i>Endangered Species Recovery Program</i>	a cooperative research program on biodiversity conservation in central California, administered by California State University, Stanislaus Foundation
<i>endemic, endemism</i>	restricted in occurrence to a stated site or area (e.g., endemic to California)
<i>entire</i>	untoothed or smooth (said of the margin of a leaf)
<i>estrus</i>	periodic physiological state in female mammals that immediately precedes ovulation; heat
<i>extant</i>	still in existence
<i>eye-spots</i>	rounded structures on cactus pads that contain barbed bristles
<i>florets</i>	tiny flowers characteristic of the aster family
<i>forb</i>	broad-leaved herb
<i>guild</i>	meaning a group of species with a common need for a particular habitat or other niche component
<i>gular</i>	throat area
<i>gynodioecy</i>	a state of certain plant populations characterized by a mixture of plants with flowers having only female parts and plants with flowers having both male and female parts (adjective: gynodioecious)
<i>habitat protection</i>	ensuring appropriate uses of land to maintain and optimize species habitat values
<i>halophyte</i>	plant tolerant of alkaline and saline soils
<i>hemiparasitic</i>	obtaining water and nutrients from the roots of other plants then manufacturing food through photosynthesis (noun: hemiparasitism)
<i>host plant</i>	the source of water and nutrients for a parasitic plant
<i>hydrologic regime</i>	seasonal water cycles and movements

B. Glossary of Technical Terms (continued)

Term	Definition
<i>keystone species</i>	species that have key roles in shaping the environment that affects the presence or absence of other organisms; usually the presence of a keystone species leads to a greater variety of species
<i>leaf axil</i>	the point where a leaf is attached to a stem
<i>lips</i>	groups of fused petals that differ in appearance
<i>lobes</i>	free tips of flower or leaf parts that are fused at the base
<i>matrilineal</i>	tracing ancestral descent through the maternal line
<i>matrix projection modelling</i>	a mathematical technique that uses life history data to identify critical stages in the life cycle of an organism and project population growth rates (Menges 1986, Schemske et. al. 1994)
<i>microhabitat</i>	localized areas with unique conditions due to small-scale variations in physical features of the landscape
mitigation bank	large blocks of land preserved, restored, and enhanced for purposes of consolidating mitigation for and mitigating in advance for projects that take listed species
<i>metapopulation</i>	scattered groups of plants or animals that may function as a single population due to occasional interbreeding
<i>mosaic</i>	interspersed patches of vegetation each dominated by a different species
<i>occurrences</i>	collection sites separated by 0.4 kilometers (0.25 miles) or more
<i>pad</i>	the fleshy flattened green stem of a cactus
<i>palmate</i>	deeply divided into finger-like segments (usually in reference to leaf shape)
<i>phenology</i>	timing of different stages in the life cycle of a plant
<i>pistillate</i>	having only female reproductive parts (said of a flower)
<i>playa</i>	a shallow temporary lake that may form in alkali sinks
<i>poikilothermic</i>	having a body temperature that varies with the temperature of its surroundings (cold-blooded animals)
<i>polygyny</i>	mating pattern in which a male mates with more than one female in a single breeding season
<i>postpartum</i>	soon after giving birth
<i>precinct</i>	area over and around the burrow system of a giant kangaroo rat in which most activity takes place

B. Glossary of Technical Terms (continued)

Term	Definition
<i>ray florets</i>	tiny flowers with flattened fused petals that occur near the margin of a flower head in a member of the Aster family (e.g. the petals of a common daisy)
<i>Salinas-Pajaro Region</i>	areas of the Salinas River and Pajaro River watersheds with habitat for kit foxes
<i>savanna</i>	a combination of grassland and woodland in which the trees are widely scattered
<i>scrub</i>	shrubland dominated by shrubs less than 2 meters (6 feet) tall
<i>stamen</i>	the male reproductive part of a plant
<i>style</i>	part of the female reproductive system of a plant
<i>superciliary stripe</i>	a stripe above the eye
<i>taxon</i>	a taxonomic unit of any rank, often used to refer to an entity that is considered by some to be a subspecies and others to be a species (plural: taxa)
<i>tubercle</i>	a wart-like projection
<i>type specimen</i>	the individual plant or animal that was the basis for the original description of a scientific name
<i>type locality</i>	the site from which a type specimen was collected
<i>umbrella species</i>	a species that lives in many biotic communities or has broad habitat requirements that if provided for and protected will protect the habitat of many other species
<i>unicuspids</i>	teeth behind the incisors that have a single main chewing surface (cusp)
<i>vegetative reproduction</i>	the production of new plants from sources other than seed (e.g., from cuttings or root runners)
<i>USBLM</i>	U.S. Bureau of Land Management
<i>USFWS</i>	U.S. Fish & Wildlife Service
<i>western Kern County</i>	Naval Petroleum Reserves in California, Lokern Natural Area, and adjacent natural lands



C. PRIORITIES FOR RECOVERY OF THREATENED AND ENDANGERED SPECIES
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Degree of Threat	Recovery Potential	Taxonomy	Priority	Conflict
High	High	Monotypic Genus	1	1C
				1
	High	Species	2	2C
				2
	High	Subspecies	3	3C
				3
	Low	Monotypic Genus	4	4C
				4
	Low	Species	5	5C
				5
	Low	Subspecies	6	6C
				6
Moderate	High	Monotypic Genus	7	7C
				7
	High	Species	8	8C
				8
	High	Subspecies	9	9C
				9
	Low	Monotypic Genus	10	10C
				10
	Low	Species	11	11C
				11
	Low	Subspecies	12	12C
				12
Low	High	Monotypic Genus	13	13C
				13
	High	Species	14	14C
				14
	High	Subspecies	15	15C
				15
	Low	Monotypic Genus	16	16C
				16
	Low	Species	17	17C
				17
	Low	Subspecies	18	18C
				18

D. RETIREMENT OF FARMLAND WITH DRAINAGE PROBLEMS

Retirement of irrigated farmland is one component of the plan to manage the drainage-related problems along the center and western side of the San Joaquin Valley (San Joaquin Valley Drainage Program in litt. 1990; HR429, 1992). The State of California also has a retirement program (San Joaquin Valley Drainage Relief Act, 1992, SB 1669) directly linked to water marketing. The program is intended to be self-supporting once an initial State appropriation provides for farmland purchase. Land retirement and selling of water rights will then provide the funds to sustain the program. Both programs can contribute greatly to recovery of several listed species if operated to solve endangered species recovery and drainage problems as two principal objectives. The nature of the State program makes it most applicable to acquiring smaller, strategic parcels next to natural lands that can provide linkages between larger blocks of natural lands. It could be operated in conjunction with mitigation programs for large-area Habitat Conservation Plans such as for the Metropolitan Bakersfield Area and the Kern County Valley Floor. The Federal program is better suited to creating large blocks of retired farmland within Central Valley Project areas that will support kit foxes (the umbrella species) and populations of associated listed and candidate species and species of concern.

1. Criteria for Federal Land Retirement Program

Qualifying criteria for the Federal Land Retirement Program should include endangered species recovery. Currently, the primary criteria qualifying land for retirement are improving water conservation and the quality of agricultural wastewater. Endangered species recovery objectives that should be considered as second order criteria include the following:

- a. Retirement of farmland should contribute to recovery of the San Joaquin kit fox and its associated communities.
- b. Land should be retired in blocks instead of scattered parcels. This minimizes “edge” with neighboring farmland and thereby minimizes pest and other problems at the interface between cultivated and natural ground. Blocks should be as large as possible; ideally no less than about 2,023–2,428 hectares

(5,000–6,000 acres). This would provide habitat for 3–8 or more families of foxes and contribute to minimizing edge.

- c. Blocks ideally should be circular or square in shape. This also minimizes edge.
- d. Blocks should be positioned near or within areas with artificial or natural structures serving as potential corridors for movement of kit foxes. The course of Panoche Creek between the edge of the Valley and the natural lands in the Valley’s center in Fresno and Madera Counties is one obvious potential corridor. Other potential corridors would be flood-control channels, other dry stream beds, canals, aqueducts, and drainage ditches.
- e. Blocks ideally should be connected to natural lands on the western edge of the valley by continuous undeveloped land or other natural movement corridors. This may require purchase and retirement of some lands without serious drainage problems, or substantial enhancement of kit fox habitat on farmlands through a focused safe harbor program.
- f. Blocks should contain few or no highways or major roads. Vehicles striking kit foxes are a major cause of their mortality. Large areas with few roads or with only low speed traffic minimize losses.

2. Restoration of Retired Farmland

Given sufficient time, little restoration would be needed to reestablish a natural community providing habitat for kit foxes and other target species. However, to maximize utility for recovery and minimize potential pest problems on neighboring farms, some active restoration is needed:

- a. Construction of artificial dens for kit foxes. Successful designs exist.
- b. Seeding native, barley, and other plants of annual grassland and chenopod scrub communities of the San Joaquin Valley. These are readily available and some seeding will occur naturally. The main objectives would be to provide ground cover to minimize occurrence of major weeds of croplands

and reduce soil erosion, and provide cover and food for small animals serving as prey for foxes and raptors.

- c. Creating areas of higher elevation to lessen sheet flooding in leveled fields.
- d. Retention and planting of additional trees at clustered sites to provide roosting and nesting habitat for raptors.

3. Guidelines for Land Retirement Program

Maximizing success of this proposed Federal retirement program (and the State program) requires developing trust and cooperation of participating and neighboring land owners. A successful program should:

- a. Provide exemption from incidental take (take that is incidental to, and not the purpose of, the carrying out

of an otherwise lawful activity) for both participants and neighbors. There is precedence for this type of program established by USFWS's Safe Harbor Program for the red-cockaded woodpecker in the Southeastern U.S. (USFWS in litt. 1995*c*). A similar program has been proposed for farmers in the San Joaquin Valley who enhance habitat for listed species (Scott-Graham in litt. 1994).

- b. Be implemented within an experimental environment where its effectiveness can be adequately assessed and adjustments made, as needed, and where participants can "opt out" without causing "take" of endangered species or their habitat if participants' goals are not being met.
- c. Provide for withdrawal from the retirement program without the participant being subject to violation of the endangered species acts (state and Federal).



E. SAFE HARBOR PROGRAMS

A Safe Harbor Agreement is a voluntary agreement between one or more private or nonfederal landowners and the USFWS to restore, enhance or maintain habitats for listed species, proposed species, candidates or other species of concern. Under the Agreement, the landowner would be provided assurances that additional land use restrictions as a result of their voluntary conservation actions would not be imposed by the USFWS. If the Agreement provides a net conservation benefit to the covered species and the landowner meets all the terms of the Agreement, the USFWS would authorize the incidental taking of covered species to enable the landowner to return the enrolled lands to agreed upon conditions.

Several variations of a safe harbor program are needed to assist in endangered species recovery in the San Joaquin Valley. A general program is needed Valley-wide to encourage farmers to voluntarily create, maintain, and enhance habitat for wildlife and native plants within the farmland mosaic. This program is needed both to increase the value of farmlands for wildlife and to engender trust between farmers and the regulatory agencies. It could apply to islands of natural lands and retired farmland as well as actively farmed ground. The general program, however, should *not* include enhancement of kit fox habitat unless it is set within an experimental framework with scientifically-acceptable levels of baseline measurements of habitat and populations; careful, frequent quantitative monitoring; and provisions to assess risks of the program in attracting and enhancing numbers of red foxes and their impacts on kit foxes. Different criteria and monitoring requirements (by resource management agencies) are needed on lands that currently support listed species compared to lands with no existing endangered species.

1. Components of a Pilot Safe Harbor Program

A more specific safe harbor program, directed at enhancing kit fox populations within the agricultural-natural lands mosaic on the Valley floor and the movement of foxes between the larger populations both on the floor and around the Valley's edge is needed. This program must begin on a small scale and be set within an experimental framework with scientifically acceptable procedures for measurement or identification of:

- a. baseline population numbers and habitat, and changes in population sizes with changes in cultural practices and habitat enhancements;
- b. proportion of foraging time in different crops and in crops with different cultural practices;
- c. prey numbers associated with different crops and cultural practices;
- d. food habitats (including types of crop plants eaten);
- e. home range size and configuration with identification of landscape features used as movement paths;
- f. dispersal movements;
- g. population recruitment;
- h. denning sites and structure of dens;
- i. effects of the program on red foxes, habitat features associated with red foxes, and interactions between red foxes and kit foxes, if any.

The greatest concern is that though this program seems essential for kit fox recovery, efforts at enhancing kit fox populations on the Valley floor may actually enhance red fox numbers, which may prey on and displace kit foxes from these areas. Thus, the program has a real, but unknown probability of doing more harm than good for recovery of kit foxes. It should only be implemented as a tightly-controlled scientific experiment.

2. Target Areas for San Joaquin Kit Fox Safe Harbor Program

Areas where safe harbor programs can potentially contribute substantially to recovery of kit foxes are:

- a. Farmland and small islands of natural lands along the northwest edge of the San Joaquin Valley from south of Los Banos in Merced County to the Delta region in San Joaquin, Alameda, and Contra Costa Counties;
- b. Natural lands supporting grasslands and oak savanna in eastern Stanislaus, Merced, and Madera Counties;

- c. Natural land and farmland in Merced County in the area along Sandy Mush Road and farmland linking the natural lands along Sandy Mush Road with the natural lands to the east in southern Merced and Madera Counties;
- d. Natural land and farmland along the San Joaquin River and Chowchilla Bypass between the wildlife refuges in Merced County and the natural lands in western Madera County;
- e. Farmland in western Fresno County along the major flood channels of ephemeral streams draining the coastal ranges to the San Joaquin River-Fresno Slough in the center of the Valley; and on any retired farmlands in the area that remain in private ownership after retirement;
- f. Farmland that is periodically not farmed for more than 2 or 3 years at a time along the western edge of the Valley in Fresno, Kings, and Kern Counties;
- g. Farmland and natural lands along the Highway 46 Corridor between natural lands west of Blackwell's Corner, Kern County, and natural lands in the Semitropic Ridge Area;
- h. Farmland and natural lands between the Semitropic Ridge Area and the Pixley-Allensworth Natural Area, along the Garces Highway corridor;
- i. Farmland and natural lands within the Pixley-Allensworth Natural Area and between this area and Creighton Ranch Preserve to the north;
- j. Farmland and natural lands along Poso Creek between natural lands in the Sierra foothills on the east and Kern National Wildlife Refuge on the west;
- k. Natural land and farmland along the Estrella River tributaries in San Luis Obispo County;
- l. Natural land and farmland elsewhere in the Salinas River watershed in San Luis Obispo and Monterey Counties.
- m. Natural land along the Kern River within the Bakersfield metropolitan area and westward.
- n. Natural land and farmlands between the Kettleman Hills and Anticline Ridge in Fresno County.
- o. Natural land along San Juan Creek from Shandon on the northwest, southeastward along the tributaries of the Creek's watershed, including dryland grain fields in the Conservation Reserve program.
- p. San Joaquin Valley foothills with grassland and saltbush scrub communities from western Madera County southward to the southern end of the Valley, then eastward and northward through Tulare County; and on the northeast in eastern Madera, Merced, and Stanislaus Counties.
- q. Natural lands in the Cuyama River watershed between about Cottonwood Canyon on the west, eastward and southward to the vicinity of Ballinger and Santa Barbara canyons, including the lower reaches of the canyons where habitats for featured species are found.

Much of the planning area may eventually be included in safe harbor programs for the San Joaquin kit fox, but a phased approach is recommended. The first phase must be carefully controlled and needs to identify the farmland features and cultural practices that are associated with success in terms of kit fox survival, population recruitment, and dispersal movements, as well as any negative effects from the alien red foxes. Later phases should be instituted first in areas identified as being important in promoting connectivity between major kit fox populations and include features identified as of positive value to the program objectives. These would be phased in as landowner participation and funding warrant. At all phases of the program, scientifically acceptable monitoring and analysis should be conducted. This is essential to evaluate the efficacy of the programs and their contributions to recovery, and to identify and ward off potential problems such as those associated with red foxes.

